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Reno, NV 89502 (US).

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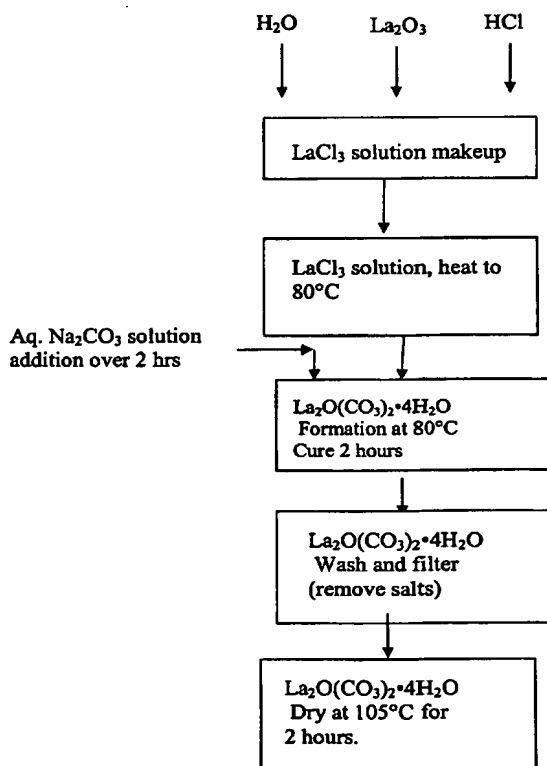
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(54) Title: RARE EARTH COMPOSITIONS AND STRUCTURES FOR REMOVING PHOSPHATES FROM WATER

(57) Abstract: A rare-earth compound selected from the group
consisting of rare earth anhydrous oxycarbonate and rare earth
hydrated oxycarbonate, with a surface area of at least 10m²/g,
suitable for the removal of phosphate from water.





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According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ, CHEM ABS Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 02/22258 A (UNION CARBIDE CHEMICALS & PLASTICS TECHNOLOGY CORPORATION) 21 March 2002 (2002-03-21) page 15, line 14 - page 16, line 2; claims 22-24	1-17
Y		18-20
Y	US 5 683 953 A (MILLS DUDLEY JOHN) 4 November 1997 (1997-11-04) the whole document	18-20
A		1-17
A	US 6 146 539 A (MILLS DUDLEY JOHN) 14 November 2000 (2000-11-14) cited in the application the whole document	

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Further documents are listed in the continuation of box C.

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Information on patent family members

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Patent document cited in search report		Publication date	Patent family member(s)	Publication date
WO 0222258	A	21-03-2002	US 6403523 B1	11-06-2002
			AU 9100201 A	26-03-2002
			BR 0114462 A	01-07-2003
			CA 2422290 A1	21-03-2002
			CN 1458865 T	26-11-2003
			EP 1326710 A2	16-07-2003
			JP 2004508190 T	18-03-2004
			NO 20031210 A	16-05-2003
			WO 0222258 A2	21-03-2002
			US 2002173420 A1	21-11-2002
<hr/>				
US 5683953	A	04-11-1997	AU 675512 B2	06-02-1997
			AU 6177494 A	14-09-1994
			WO 9419286 A1	01-09-1994
			EP 0686132 A1	13-12-1995
			US 6146539 A	14-11-2000
			US 5897784 A	27-04-1999
			ZA 9406153 A	28-03-1995
<hr/>				
US 6146539	A	14-11-2000	AU 675512 B2	06-02-1997
			AU 6177494 A	14-09-1994
			WO 9419286 A1	01-09-1994
			EP 0686132 A1	13-12-1995
			US 5683953 A	04-11-1997
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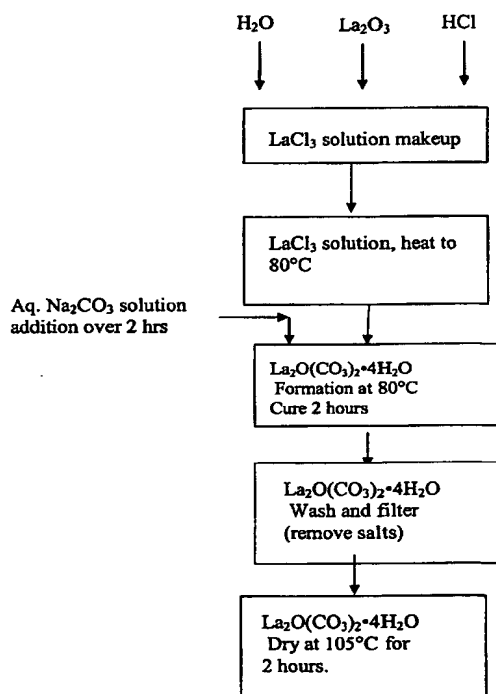
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(54) Title: RARE EARTH COMPOSITIONS AND STRUCTURES FOR REMOVING PHOSPHATES FROM WATER



(57) Abstract: A rare-earth compound selected from the group consisting of rare earth anhydrous oxycarbonate and rare earth hydrated oxycarbonate, with a surface area of at least 10m²/g, suitable for the removal of phosphate from water.



— *with amended claims*

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AMENDED CLAIMS

**[Received by the International Bureau on 30 July 2004 (30.07.04):
original claims 1, 2, 7, 12, 17-24, 33-36, 38 and 39 amended; 8-11, 13-16, 25-32, 37 and 40
cancelled, new claims 44-45 added; remaining claims unchanged]**

1. Use of a rare-earth compound selected from the group consisting of rare earth anhydrous oxycarbonate and rare earth hydrated oxycarbonate, with a surface area of at least 10 m²/g for making a composition suitable for the removal of phosphate from water.
2. Use of a rare-earth compound in the form of agglomerates of 1 to 1000 µm in size with the compound selected from the group consisting of rare earth anhydrous oxycarbonate and rare earth hydrated oxycarbonate for making a composition suitable for the removal of phosphate from water.
3. The use according to claim 1 or 2 wherein the rare earth is selected from the group consisting of lanthanum, cerium, and yttrium.
4. The use according to claim 1 or 2 where the rare earth is lanthanum.
5. The use according to claim 1 or 2 where the compound is a particle with a porous structure.
6. The use according to claim 5 where the porous structure is made by total evaporation of a rare-earth salt solution followed by calcination.
7. The use according to claim 6 where the total evaporation step is conducted in a spray dryer.
8. The use according to claim 6 where the evaporation temperature is between about 120° and 500°C.
9. The use according to claim 6 where the calcination temperature is between about 400° and about 1200 °C.

10. The use according to claim 6 where the porous particles have a size between 1 and 1000 μm .
11. The use according to claim 10 where the particles are formed from individual
5 crystals having a size between 20 nm and 10 μm .
12. The use according to claim 7 where the product is made of spheres or parts of spheres.
- 10 13. The use according to claim 6 wherein the rare earth salt solution is a rare earth acetate.
14. The use according to claim 5 wherein the rare earth salt solution is neutralized with sodium carbonate, followed by washing, filtering and drying.
- 15 15. The use according to claim 14 wherein the neutralization process takes place at a temperature between 30° and 90°C.
16. The use according to claim 15 wherein the drying takes place at a temperature of
20 about 100° to 120°C.
17. The use according to claim 16 wherein the drying takes place for a period of about 1 to 5 h.
- 25 18. A method of preventing algal growth in swimming pools and other water systems comprising providing an effective amount of the composition of claim 1 or 2.
19. The method of claim 17 wherein the composition exhibits a low solubility in water.
- 30 20. The method of claim 17 wherein the composition is added in the filtration system of a swimming pool.

21. The use according to claim 5 wherein the compound is formed from a LaCl_3 solution that has been heated to a temperature between 30° and 90° C.
- 5 22. The use according to claim 21 wherein sodium carbonate is added to the heated LaCl_3 solution to form a precipitate.
23. The use according to claim 22 wherein the precipitate is heated at a temperature between 100° and 120° C.